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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/635,275	08/06/2003	Paul Ashmore	GB920020033US1	1371

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EXAMINER
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NGUYEN, THAN VINH

ART UNIT	PAPER NUMBER
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2187

DATE MAILED: 11/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/635,275	Applicant(s) ASHMORE ET AL.	
	Examiner Than Nguyen	Art Unit 2187	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 06 August 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 37-39 is/are allowed.
- 6) ☒ Claim(s) 1,3,4,9,11,12,17-19,21-24 and 29-36 is/are rejected.
- 7) ☒ Claim(s) 2,5-8,10,13-16,20 and 25-28 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

1. Claims 1-39 are pending.
2. The amendment, filed 8/6/03, has been entered.
3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

***Claim Rejections - 35 USC § 112***

4. Claims 1,9,17,35, and recites the limitation "the tail". There is insufficient antecedent basis for this limitation in the claim.
5. Claims 2-8,10-34 are also rejected for incorporating the deficiency of the parent claim.
6. Claim 5,21-28 recites the limitation "the head". There is insufficient antecedent basis for this limitation in the claim.
7. Claim 2 recites the limitation "the destaged data" in line 3. There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1,3,4,9,11,12,17-19,21-24,29-36 are rejected under 35 U.S.C. 102(b) as being anticipated by Cohn et al (US 5,734,861).

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As to claims 1,9,17,35,36:

10. Cohn teaches a log-structured array of disk drive units. Cohn teaches the claimed computer program product/system for performing: referencing dirty data stored in the data cache using a first recently used list dirty LRU; Fig. 4); referencing clean data stored in the data cache using a second least recently used list (Clean LRU; Fig. 4; 6/53-63); wherein the dirty data is destaged from the data cache when the dirty data reaches the tail of the first recently used list and the clean data is purged from the data cache when the clean data reaches the tail of the second least recently used list (dirty data is destaged from dirty LRU and clean data is purged/removed from clean LRU; 6/58-63, 7/10-15, 9/39-52, 11/5-14, 12/60-65).

As to claim 3,11:

11. Cohn teaches fetching data from the storage device and storing it in the cache with a reference in the second LRU upon a cache miss (7/38-42; 8/40-47).

As to claim 4,12:

12. Cohn teaches keeping a flag with each data reference in the first LRU indicating whether the data has been read (12/60-65).

As to claim 18:

13. Cohn teaches the dirty data is data received from the host computer (6/53-63, 8/45-50)

As to claim 19, 32:

14. Cohn teaches clean data is destaged to a storage device (Fig. 8)

As to claim 21-24:

15. Cohn teaches when a virtual track of dirty/clean data is inserted into the data cache, a reference is added to the head of the first/second LRU (adding a new dirty/clean entry; 11/5-14).

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As to claim 29:

16. Cohn teaches when a last clean page is purged, the reference to the virtual track is deleted from the second LRU (purging/removing from clean LRU; 9/39-53).

As to claim 30:

Cohn teaches deleting a reference of a virtual track that has no dirty data (12/55-64).

As to claim 31:

17. Cohn teaches deleting a reference to a virtual track of the second LRU when it no longer contains clean pages (11/50-58, 13/25-30).

As to claim 33,34:

18. Cohn teaches a disk drive coupled to the storage controller (28; Fig. 1).

***Allowable Subject Matter***

19. Claims 2,5-8,10,13-16, 20,25-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

20. As to claim 2,10 the prior art does not further teach wherein the dirty data is destaged to a data storage device and deleted from the first least recently used list is retained and reference to the destaged data is added to the second least recently used list and a copy of the destaged data is retained in the cache as clean data.

21. As to claim 5,13 the prior art does not further teach wherein, if the data was read when referenced in the first least recently used list, the data is added to the head of the second least recently used list when the data is destaged.

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22. As to claim 6,14 the prior art does not further teach wherein, if the data was not read when referenced in the first least recently used list, the data is one of either maintained in the current position in the second least recently used list or discarded.

23. As to claim 7,20,15 the prior art does not further teach wherein, keeping the flag comprises including a timestamp each time the data is read.

24. As to claim 8,16 the prior art does not further teach wherein, virtual track of the data comprises partially dirty data and partially clean data and the virtual track is referenced in both the first least recently used list and second least recently used list.

25. As to claim 25 the prior art does not further teach wherein, when dirty data is merged into a virtual track referenced in both the first least recently used list and the second least recently used list, the reference in the first least recently used list is moved to the head of the first least recently used list and the reference in the second least recently used list remains if the virtual track comprises any clean pages.

26. As to claim 26 the prior art does not further teach wherein, when clean data is merged into a virtual track referenced in the first least recently used list a read flag is set for the virtual track; the reference is left at the current location in the first least recently used list and a reference to the virtual track is added to the head of the second least recently used list if the virtual track comprises clean pages.

27. As to claim 27 the prior art does not further teach wherein, when clean data is merged into a virtual track, a reference to the virtual track in the second least recently used list is moved to the head of the second least recently used list.

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28. As to claim 28 the prior art does not further teach wherein, when clean data is merged into a virtual track referenced in both the first least recently used list and the second least recently used list, a read flag is cleared for the virtual track, and the reference to the virtual track in the first least recently used list is left at the current location and the reference to the virtual track in the second least recently used list is moved to the head of the second least recently used list.

29. Claims 37-39 are allowed.

30. As to claims 37-39 the prior art does not teach the claimed program further responsive to a data write being received in a data cache, for placing a data descriptor for the data at a head of a Least Recently Written (LRW) list as dirty data, and for maintaining a flag with the data descriptor for indicating if the data is read; said program code being further responsive to the data descriptor moving down the LRW list, until it reaches a tail of the LRW list, for destaging the data to at least some of said plurality of disk drives and for determining if the data descriptor is currently in a Least Recently Read (LRR) list and, if the data descriptor is currently in the LRR list, maintaining the data descriptor at its current location in the LRR list, while if the data descriptor is currently not in the LRR list, testing the flag to determine if the data has been read while the data descriptor was in the LRW list and, if the data was read while in the LRW list, the data descriptor is placed at the head of the LRR list, otherwise the data is discarded.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Than Nguyen whose telephone number is 571-272-4198. The examiner can normally be reached on 8am-3pm M-F.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Than Nguyen can be reached on (571) 272-4201. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Than Nguyen  
Primary Examiner  
Art Unit 2187